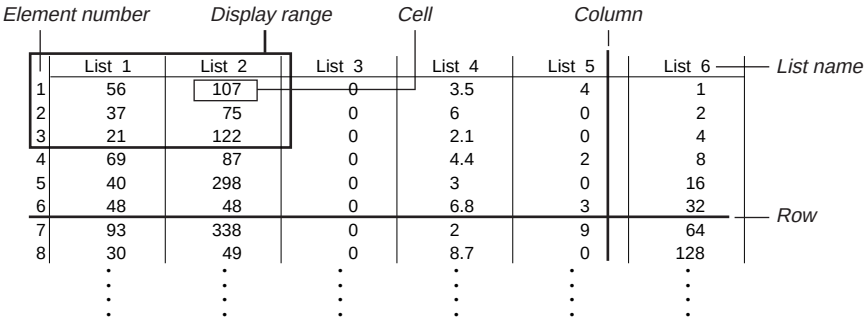
Chapter 6

List Function

A list is a kind of container that you can use to store multiple data items. This calculator lets you have up to six lists in memory, and their contents can be used in arithmetic calculations, statistical calculations and for graphing.



1. **List Operations**
2. **Editing and Rearranging Lists**
3. **Manipulating List Data**
4. **Arithmetic Calculations Using Lists**

■ List Data Linking

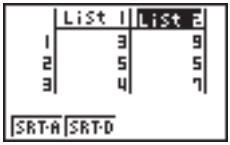
Operation

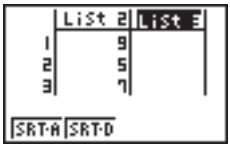
Graph

List operation

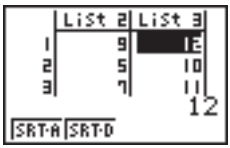
Example:
List 1 + List 2
{1, 2, 3} + {4, 5, 6}
List 1 + 3

List internal operations





EXE



Graphing with list data

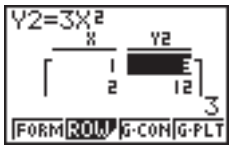
Example:
Y1=List 1X

LIST

List data can be assigned to a variable for generation of a table (defined using set-up screen).

Table

Copying table result to a list



OPTN

F1 (LIST)

F2 (LMEM)

Specific selected data can be copied to a list.

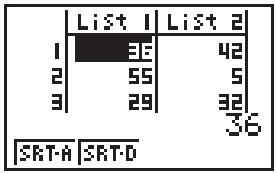
1. List Operations

Select the **LIST** icon in the Main Menu and enter the LIST Mode to input data into a list and to manipulate list data.

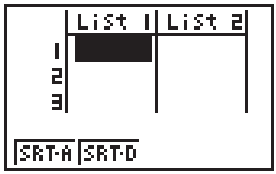
●To input values one-by-one

Use ◀ and ▶ to move between lists, and ▲ and ▼ to move between cells inside of a list.

The screen automatically scrolls when the cursor is located at the edge of the screen.

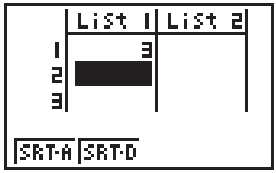


For our example, we will start by locating the cursor in Cell 1 of List 1.



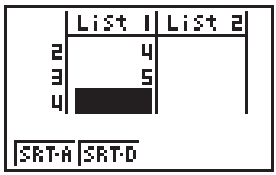
1. Input a value and press [EXE] to store it in the list.

   [3] [EXE]



2. The cursor automatically moves down to the next cell for input.
   Let's continue our example by inputting the values 4 and 5.

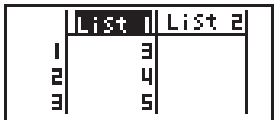
   [4] [EXE] [5] [EXE]



●To batch input a series of values

1. Use ▲ to move the cursor to the list name.

▲▲▲▲



2. Use ◀ or ▶ to move the cursor to another list.

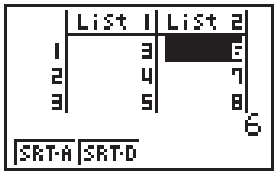
▶

3. Press SHIFT ({), and then input the values you want, pressing (,) between each one. Press SHIFT (}) after inputting the final value.

SHIFT { 6 , 7 , 8 SHIFT }

4. Press EXE to store all of the values in your list.

EXE



- Remember that a comma separates values, so you should not input a comma after the final value of the set you are inputting.

  Right: {34, 53, 78}
  Wrong: {34, 53, 78,}

2. Editing and Rearranging Lists

■ Editing List Values

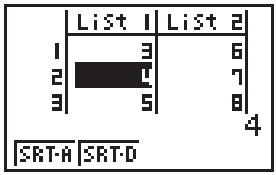
●To change a cell value

Use ◀ or ▶ to move the cursor to the cell whose value you want to change. Input the new value and press EXE to replace the old data with the new one.

●To delete a cell

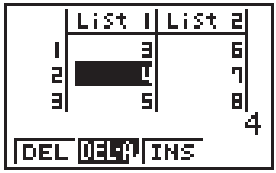
1. Use ◀, ▶, ▲, or ▼ to move the cursor to the cell you want to delete.

▼◀



2. Press ▷ to display the Cell Operation Menu.

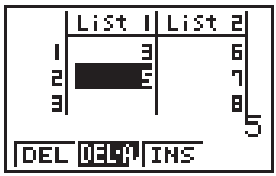
▷



F1

3. Press F1 (DEL) to delete the selected cell and cause everything below it to be shifted up.

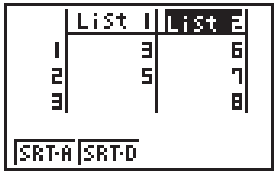
F1(DEL)



• Note that the above cell delete operation does not affect cells in other lists. If the data in the list whose cell you delete is somehow related to the data in neighboring lists, deleting a cell can cause related values to become misaligned.

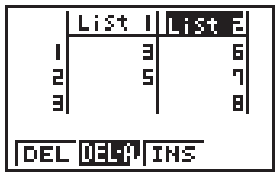
●To delete all cells in a list

1. Use ◀, ▶, ▲ or ▼ to move the cursor to the name of the list whose cells you want to delete.



2. Press ▷ to display the Cell Operation Menu (if it is not already displayed).

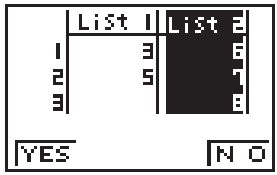
▷



F2

3. Press F2 (DEL-A). The function menu changes to confirm whether you really want to delete all the cells in the list.

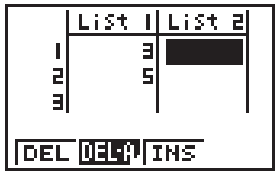
F2(DEL-A)



F1 F4

4. Press F1 (YES) to delete all the cells in the selected list or F4 (NO) to abort the delete operation without deleting anything.

F1(YES)



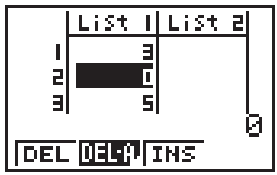
●To insert a new cell

Use ◀, ▶, ▲, or ▼ to move the cursor to the location where you want to insert the new cell. In this example, we will reinsert a cell containing the value 4, which we deleted above.

1. Press ▷ to display the Cell Operation Menu (if it is not already displayed).

2. Press F3 (INS) to insert a new cell, which contains a value of 0, causing everything below it to be shifted down.

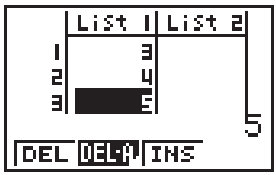
F3(INS)



F3

3. Input the value you want into the new cell (4 in our example) and press [EXE].

[4] [EXE]



- Note that the above cell insert operation does not affect cells in other lists. If the data in the list where you insert a cell is somehow related to the data in neighboring lists, inserting a cell can cause related values to become misaligned.

■ Sorting List Values

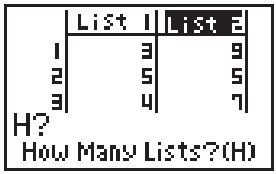
You can sort lists into either ascending order or descending order. The current cursor location does not matter in the following procedures.

●To sort a single list

Ascending order

1. While the lists are on the screen, press [▷] to display the Operation Menu and then press [F1] (SRT-A).

[▷] [F1](SRT-A)

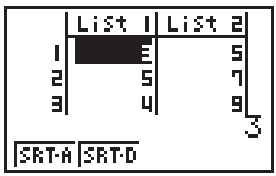


2. The prompt “How Many Lists? (H)” appears to ask how many lists you want to sort. Here we will input 1 to indicate we want to sort only one list.

[1] [EXE]

3. In response to the “Select List (L)” prompt, input the number of the list you want to sort. Here we will input 2 to specify sorting of List 2.

[2] [EXE]



The values in List 2 are sorted into ascending order.

Descending order

Use the same procedure as that for the ascending order sort. The only difference is that you should press [F2] (SRT-D) in place of [F1] (SRT-A).

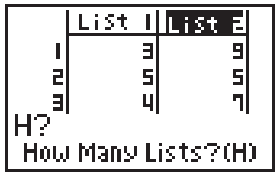
●To sort multiple lists

You can link multiple lists together for a sort so that all of their cells are rearranged in accordance with the sorting of a base list. The base list is sorted into either ascending order or descending order, while the cells of the linked lists are arranged so that the relative relationship of all the rows is maintained.

Ascending order

1. While the lists are on the screen, press [F1] (SRT-A).

[F1](SRT-A)



2. The prompt “How Many Lists? (H)” appears to ask how many lists you want to sort. Here we will sort one base list linked to one other list, so we should input 2.

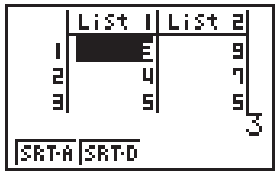
[2] [EXE]

3. In response to the “Select Base List (B)” prompt, input the number of the list you want to sort into ascending order. Here we will specify List 1.

[1] [EXE]

4. In response to the “Select Second List (L)” prompt, input the number of the list you want to link to the base list. Here we will specify List 2.

[2] [EXE]



The values in List 1 are sorted into ascending order, and the cells of List 2 are also rearranged to keep the same relationship with the List 1 cells.

Descending order

Use the same procedure as that for the ascending order sort. The only difference is that you should press [F2] (SRT-D) in place of [F1] (SRT-A).

3. Manipulating List Data

List data can be used in arithmetic and function calculations. There is also a collection of powerful list data manipulation functions that let you do the following.

- Count the number values (Dim)
- Replace all cell values with the same value (Fill)
- Generate a sequence of numbers (Seq)
- Find the minimum value in a list (Min)
- Find the maximum value in a list (Max)
- Find which of two lists contains the smallest value (Min)
- Find which of two lists contains the greatest value (Max)
- Calculate the mean of list values (Mean)
- Calculate the mean of values of specified frequency (Mean)
- Calculate the median of values in a list (Med)
- Calculate the median of values of specifies frequency (Med)
- Calculate the sum of values in a list (Sum)

You can use list data manipulation functions in the **RUN**, **STAT**, **LIST**, **TABLE**, or **PRGM Mode**.

■ Accessing the List Data Manipulation Function Menu

All of the following examples are performed after entering the **RUN Mode**.

Press [OPTN] and then [F1] (LIST). This menu has three pages and you can advance to the next page by pressing [▷].

Note that all closing parentheses at the end of the following operations can be omitted.

●To count the number of values (Dim)

[OPTN] [F1](LIST) [F3](Dim) [F1](List) <list number 1-6> [EXE]

- The number of cells that contain data in a list is called its “dimension.”

Example **To enter the RUN Mode and count the number of values in List 1 (36, 16, 58, 46, 56)**

[AC] [OPTN] [F1](LIST) [F3](Dim)
[F1](List) [1] [EXE]

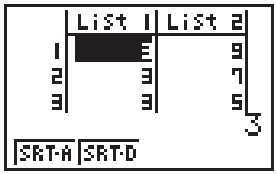
●To replace all cell values with the same value (Fill)

OPTN F1 (LIST) F4 (Fill) <value> , F1 (List) <list number 1-6>) EXE

Example **To replace all values in List 1 (36, 16, 58, 46, 56) with 3**

AC OPTN F1 (LIST) F4 (Fill)
3 , F1 (List) 1) EXE

The following shows the new contents of List 1.



●To generate a sequence of numbers (Seq)

OPTN F1 (LIST) ▷ F1 (Seq) <expression> , <variable name> ,
<start value> , <end value> , <pitch>) EXE

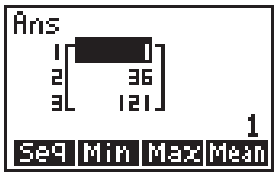
- The result of this operation is also stored in Ans Memory.

Example **To input the number sequence 1^2, 6^2, 11^2 into a list**

Use the following settings.
Variable: *x*
Starting value: 1
Ending value: 11
Pitch: 5

AC OPTN F1 (LIST) ▷ F1 (Seq)
X,T x² , X,T , 1 , 1 1 , 5)

EXE



Specifying an ending value of 12, 13, 14, or 15 produces the same result as shown above, because all of them are less than the value produced by the next increment (16).

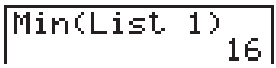
The resulting sequence is input into Ans Memory.

●To find the minimum value in a list (Min)

OPTN F1 (LIST) ▷ F2 (Min) ▷ ▷ F1 (List) <list number 1-6>) EXE

Example **To find the minimum value in List 1 (36, 16, 58, 46, 56)**

AC OPTN F1 (LIST) ▷ F2 (Min)
▷ ▷ F1 (List) 1) EXE



●To find the maximum value in a list (Max)

Use the same procedure as when finding the minimum value, except press F3 (Max) in place of F2 (Min).

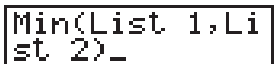
●To find which of two lists contains the smallest value (Min)

OPTN F1 (LIST) ▷ F2 (Min) ▷ ▷ F1 (List) <list number 1-6> ,
F1 (List) <list number 1-6>) EXE

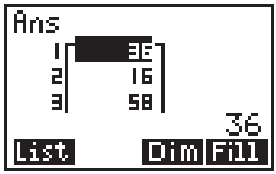
- The two lists must contain the same number of values. If they don't, an error (Dim ERROR) occurs.
- The result of this operation is also stored in Ans Memory.

Example **To find whether List 1 (75, 16, 98, 46, 56) or List 2 (36, 89, 58, 72, 67) contains the smallest value**

AC OPTN F1 (LIST) ▷ F2 (Min)
▷ ▷ F1 (List) 1 ,
F1 (List) 2)



EXE



●To find which of two lists contains the greatest value (Max)

Use the same procedure as that for the smallest value, except press F3 (Max) in place of F2 (Min).

- The two lists must contain the same number of values. If they don't, an error (Dim ERROR) occurs.

●To calculate the mean of list values (Mean)

OPTN F1 (LIST) ▷ F4 (Mean) ▷ ▷ F1 (List) <list number 1-6>) EXE

Example **To calculate the mean of values in List 1 (36, 16, 58, 46, 56)**

AC OPTN F1 (LIST) ▷ F4 (Mean)
▷ ▷ F1 (List) 1) EXE

```
Mean(List 1)
          42.4
```

●To calculate the mean of values of specified frequency (Mean)

This procedure uses two lists: one that contains values and one that contains the number of occurrences of each value. The frequency of the data in Cell 1 of the first list is indicated by the value in Cell 1 of the second list, etc.

- The two lists must contain the same number of values. If they don't, an error (Dim ERROR) occurs.

OPTN F1 (LIST) ▷ F4 (Mean) ▷ ▷ F1 (List) <list number 1-6(data)>
, F1 (List) <list number 1-6 (frequency)>) EXE

Example **To calculate the mean of values in List 1 (36, 16, 58, 46, 56), whose frequency is indicated by List 2 (75, 89, 98, 72, 67)**

AC OPTN F1 (LIST) ▷ F4 (Mean)
▷ ▷ F1 (List) 1 , F1 (List) 2) EXE

```
Mean(List 1,L
ist 2)
  42.07481297
```

●To calculate the median of values in a list (Med)

OPTN F1 (LIST) ▷ ▷ F1 (Med) ▷ F1 (List) <list number 1-6>) EXE

Example **To calculate the median of values in List 1 (36, 16, 58, 46, 56)**

AC OPTN F1 (LIST) ▷ ▷ F1 (Med)
▷ F1 (List) 1) EXE

```
Median(List 1
)
          46
```

●To calculate the median of values of specified frequency (Med)

This procedure uses two lists: one that contains values and one that contains the number of occurrences of each value. The frequency of the data in Cell 1 of the first list is indicated by the value in Cell 1 of the second list, etc.

- The two lists must contain the same number of values. If they don't, an error (Dim ERROR) occurs.

OPTN F1 (LIST) ▷ ▷ F1 (Med) ▷ F1 (List) <list number 1-6 (data)>
, F1 (List) <list number 1-6 (frequency)>) EXE

Example **To calculate the median of values in List 1 (36, 16, 58, 46, 56), whose frequency is indicated by List 2 (75, 89, 98, 72, 67)**

AC OPTN F1 (LIST) ▷ ▷ F1 (Med)
▷ F1 (List) 1 , F1 (List) 2) EXE

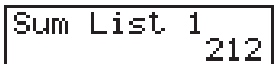
```
Median(List 1
,List 2)
          46
```

●To calculate the sum of values in a list (Sum)

OPTN F1 (LIST) ▷ ▷ F2 (Sum) ▷ F1 (List) <list number 1-6> EXE

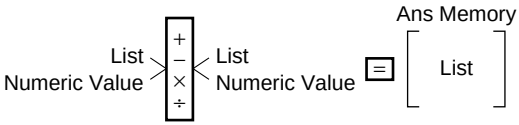
Example **To calculate the sum of values in List 1 (36, 16, 58, 46, 56)**

AC OPTN F1 (LIST) ▷ ▷ F2 (Sum)
▷ F1 (List) 1 EXE



4 Arithmetic Calculations Using Lists

You can perform arithmetic calculations using two lists or one list and a numeric value.



Calculation results are stored in Ans Memory.

■ Error Messages

- A calculation involving two lists performs the operation between corresponding cells. Because of this, a Dim ERROR occurs if the two lists do not have the same number of values (which means they have different “dimensions”).
- An Ma ERROR occurs whenever an operation involving any two cells generates a mathematical error.

■ Inputting a List into a Calculation

There are two methods you can use to input a list into a calculation.

●To input a specific list by name

Example **To input List 6**

1. Press OPTN to display the first Operation Menu.
   - This is the function key menu that appears in the **RUN** or **PRGM Mode** when you press OPTN.

OPTN

2. Press F1 (LIST) to display the List Data Manipulation Menu.

   F1(LIST)

F1

3. Press F1 (List) to display the "List" command and input the number of the list you want to specify.

   F1(List) 6

   (Input List 6.)

●To directly input a list of values

You can also directly input a list of values using {, }, and ,.

Example **To multiply List 3** $\begin{bmatrix} 41 \\ 65 \\ 22 \end{bmatrix}$ **by the list** $\begin{bmatrix} 6 \\ 0 \\ 4 \end{bmatrix}$

OPTN F1(LIST) F1(List) 3 × SHIFT { 6 , 0 , 4 SHIFT } EXE

The resulting list $\begin{bmatrix} 246 \\ 0 \\ 88 \end{bmatrix}$ is stored in Ans Memory.

●To assign the contents of one list to another list

Use → to assign the contents of one list to another list.

Example 1 **To assign the contents of List 3 to List 1**

OPTN F1(LIST) F1(List) 3 → F1(List) 1 EXE

In place of F1 (List) 3 operation in the above procedure, you could input SHIFT { 4 1 , 6 5 , 2 2 SHIFT }.

Example 2 **To assign the list in Ans Memory to List 1**

OPTN F1(LIST) F1(List) SHIFT Ans → F1(List) 1 EXE

●To input a single list cell value into a calculation

You can extract the value in a specific cell of a list and use it in a calculation. Specify the cell number by enclosing it between square brackets using the [and] keys.

Example **To calculate the sine of the value stored in Cell 3 of List 2**

sin OPTN F1(LIST) F1(List) 2 SHIFT [3 SHIFT] EXE

●To input a value into a specific cell

You can input a value into a specific cell inside a list. When you do, the value that was previously stored in the cell is replaced with the new value you input.

Example **To input the value 25 into cell 2 of List 3**

[2] [5] [→] [OPTN] [F1](LIST) [F1](List) [3] [SHIFT] [(] [2] [SHIFT] [)] [EXE]

■ Recalling List Contents

Example **To recall the contents of List 1**

[OPTN] [F1](LIST) [F1](List) [1] [EXE]

- The above operation displays the contents of the list you specify and also stores them in Ans Memory. You can then use the Ans Memory contents in a calculation.

●To use list contents in Ans Memory in a calculation

Example **To multiply the list contents in Ans Memory by 36**

[OPTN] [F1](LIST) [F1](List) [SHIFT] [Ans] [×] [3] [6] [EXE]

- The operation [OPTN] [F1] (LIST) [F1] (List) [SHIFT] [Ans] recalls Ans Memory contents.
- This operation replaces current Ans Memory contents with the result of the above calculation.

■ Graphing a Function Using a List

When using the graphing functions of this calculator, you can input a function such as Y1 = List1 X. If List 1 contains the values 1, 2, 3, this function will produces three graphs: Y = X, Y = 2X, Y = 3X.

There are certain limitations on using lists with graphing functions.

■ Inputting Scientific Calculations into a List

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You can use the numeric table generation functions in the Table Mode to input values that result from certain scientific function calculations into a list. To do this, first generate a table and then use the list copy function to copy the values from the table to the list.

■ Performing Scientific Function Calculations Using a List

Lists can be used just as numeric values are in scientific function calculations. When the calculation produces a list as a result, the list is stored in Ans Memory.

Example 1 **To use List 3** $\begin{bmatrix} 41 \\ 65 \\ 22 \end{bmatrix}$ **to perform sin (List 3)**

Use radians as the angle unit

sin OPTN F1 (LIST) F1 (List) 3 EXE

The resulting list $\begin{bmatrix} -0.158 \\ 0.8268 \\ -8E^{-3} \end{bmatrix}$ is stored in Ans Memory.

In place of the F1 (List) 3 operation in the above procedure, you could input SHIFT { 4 1 , 6 5 , 2 2 SHIFT } .

Example 2 **To use List 1** $\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$ **and List 2** $\begin{bmatrix} 4 \\ 5 \\ 6 \end{bmatrix}$ **to perform List 1$^{\text{List 2}}$**

List1 ^ List2 EXE

This creates a list with the results of 1^4, 2^5, 3^6.

The resulting list $\begin{bmatrix} 1 \\ 32 \\ 729 \end{bmatrix}$ is stored in Ans Memory.